OBSERVATIONS OF THE POLAR NIGHT CLOUDS ON MARS WITH THE MARS ORBITER LASER ALTIMETER (MOLA)

A. B. Ivanov (1,2) and D. O. Muhleman (2)
(1) MS168-514, Jet Propulsion Laboratory, Pasadena, CA, 91109, (2) Caltech, MS150-21, 1205 E. California blvd, Pasadena, CA, 91125, USA .
anton.ivanov@jpl.nasa.gov

In this presentation we will discuss continuing observations of the polar night clouds with the Mars Orbiter Laser Altimeter (MOLA) instrument. Currently observations cover 1 full Martian year with some small amount of overlap during North and South winters. Along with the cloud height, MOLA measures the reflected energy and the returned pulse width. We will describe observations of the polar clouds and cloud opacities in the North and South Polar regions of Mars. The clouds are probably composed of CO_2 ice, which formed in very cold polar winter temperatures. We will present seasonal, spatial and elevation distributions of cloud returns. By the differences in reflective properties and spatial occurrence, we were able to classify two types of clouds : polar clouds forming poleward of 80° (channel 4 clouds) and clouds that formed only in the southern hemisphere just off the pole the latitudinal range from 70°S to 80°S (channel 1 clouds). Condensation of "channel 4" clouds is most likely triggered by propagation of gravity waves in the polar night conditions. This process was extensively modeled by *Tobie et. al.* (2000) and produced a good match with the actual observations. "Channel 1" clouds are still unexplained.
Simultaneous observations during the Science Phasing Orbit (SPO) by the MGS Thermal Emission Spectrometer (TES) enabled us to address the question of the low brightness temperature zones observed by both TES and Viking IRTM (Infrared Thermal Mapper) instruments. Based on our comparison between MOLA and TES data we suggest that most of the CO_2 frost is formed on the ground. This processes causes most of the brightness temperature minima. In some rare occasions, though, the "super-cold" spots may be caused by very extensive cloud formations.
References :
Tobie, G., Lott, F., Forget, F., 2000, Numerical Simulation of winter polar wave clouds observed by MGS Mars Orbiter Laser Altimeter, BAAS 32(3), pg. 1104.